DATE: December 21, 1973

TO: Distribution

FROM: N. I. Morris

SUBJECT: Modification of Disk Device Assignments in Multics

With the current implementation of page control, there is a limit of 18 bits on the precision of the Multics record number within a given device. This means that no device may hold more than 2^{18} Multics records. This limitation can be removed only with an extensive rewrite of a significant portion of the hardcore supervisor. One means to bypass this limitation is to install more than one disk subsystem on a 6180 system, configuring each of them as separate devices (with unique device ID's). Segments can then be assigned on both devices, either by a modification of the existing device assignment algorithm, or by using the currently implemented algorithm. The following is a proposal of a scheme to allow 2 DSU-190 disk subsystems to be configured into the Multics system. At the same time that this scheme is implemented, the software for the DSU-191 (increased capacity DSU-190) can be implemented, also allowing for 2 disk subsystems.

Current Device Assignments

Currently, Multics has provisions for 5 devices. These are summarized in the table below:

ID	Device
1	Bulk Store
2	DSU-190
3	DSU-181
4	DSU-170
5	DSU-270

The standard Multics product has no provisions for supporting DSU-170's or DSU-270's. The code to support these devices is vestigial and should be removed.

Proposed Device Assignments

Separate device ID's must be assigned for each additional disk subsystem. In addition, a separate configuration card must be provided to describe the additional subsystem. A table summarizing the proposed changes follows:

ID	Device	Config Card	
1	Bulk Store	Bulk	
2	DSU-191	D191	
3	DSU-191	E191	(second subsystem)
4	DSU-190	D190	
5	DSU-190	E190	(second subsystem)
6	DSU-181	D181	

Note that there is no provision for a second DSU-181 subsystem since it is expected that DSU-181's will only be used by the M.I.T. Development Machine in a small configuration.

Changes to Multics

To effect the above change, five modules must be changed in Multics and the Salvager: "disk_control" and "disk_init" must be modified to remove vestigial code and insert code for the new devices. "device_control" must be modified to call the correct disk DIM based on a device I.D. "initialize_dims" and "init_salv_fsdcts" must be modified as both contain device-dependent code. Some minor changes to various user ring commands such as "status", "device_meters", and "disk_queue" may also have to be made.

Changes to BOS

The BOS Disk DIM and device address conversion routines must be modified slightly. Internal tables relating device ID to device characteristics must be changed.

Changes to the Configuration Deck

All PART cards must be modified to reflect the fact that Multics now supports six devices instead of five. PART cards must be changed to reflect the change in existing device ID's.

If the additional device is to be used, its presence must be reflected by adding the appropriate config card and modifying the PART cards. A THRS card would be supplied in this case to allow spillover from one device to the next.

Installation of the System

Since existing device ID's are being modified, the new Multics system reflecting these changes can only be installed by performing a cold boot and reload.

An exception to the requirement for a cold boot would exist if the DSU-190's are converted to DSU-191's at the same time that the new system is installed. In that case, device ID's do not change. A SAVE can be done with the old software, the DSU-191 firmware loaded, the disks reformatted, the new BOS software installed, and a RESTOR done onto the DSU-191's.

DISK CAPACITY STATISTICS

	DSU-191	DSU-190	DSU-181
sectors per track	40	31	18
tracks per cylinder	19	19	20
sectors per cylinder	760	589	360
cylinders per device	410	410	202
sectors per device	311600	241490	72720
Multics records per cylinder	47	36	22
Unused sectors per cylinder	8	13	8
Multics records per device	19270	14760	4444
Avg. seek time	30 ms.	30 ms.	34 ms.
Avg. Rotational latency	8.3 ms.	8.3 ms.	12.5 ms.
Transfer time for Multics record	6.7 ms.	8.6 ms.	22.2 ms.